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Cluster-Randomized Controlled Trial of An Athletic Trainer-Directed Spit (Smokeless) Tobacco Intervention for Collegiate Baseball Athletes: Results After 1 Year

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Context: Athletes in the United States are at high risk for using spit (smokeless) tobacco (ST) and incurring its associated adverse health effects.

Objective: To examine whether an athletic trainer-directed ST intervention could decrease initiation and promote cessation of ST use among male collegiate baseball athletes.

Design: Stratified, cluster-randomized controlled trial.

Setting: Fifty-two California colleges.

Patients or Other Participant(s): A total of 883 subjects in 27 intervention colleges and 702 subjects in 25 control colleges participated, as did 48 certified athletic trainers.

Intervention(s): For college athletic trainers and associated dental professionals, a 3-hour video conference, and for collegiate athletes, an oral cancer screening with feedback and brief counseling during the preseason health screenings, athletic trainer support for cessation, and a peer-led educational baseball team meeting.

Main Outcome Measure(s): The subjects' ST use over 1 year was assessed by self-report. At the end of the study, the certified athletic trainers were mailed a survey assessing their tobacco use and perceptions and behavior related to tobacco control in the athletic environment. We used multivariable logistic regression models for clustered responses (generalized estimating equations) to test the difference between groups in ST-use initiation and cessation and to identify significant overall predictors of noninitiation and cessation of ST use.

Results: Of the 1585 athletes recruited, 1248 (78.7%) were followed up at 12 months. In addition, 48 of the 52 athletic trainers (92%) responded to the 1-year follow-up survey. The ST-use initiation (incidence) was 5.1% in intervention colleges and 8.4% in control colleges (generalized estimating equation odds ratio = 0.58, 95% confidence interval = 0.35–0.99). Predictors of ST noninitiation were low lifetime tobacco and monthly alcohol use (odds ratio = 1.98, 95% confidence interval = 1.40–2.82) and athletic trainers' report that the baseball coach supported ST-use prevention activities (odds ratio = 1.43, 95% confidence interval = 1.11–1.83). Although at 1 year, cessation of ST use was relatively high in both groups (36%), we noted no significant difference between the groups (odd ratio = 0.94, 95% confidence interval = 0.70–1.27).

Conclusions: The intervention was significantly effective in preventing incident ST use but did not significantly increase cessation beyond that seen in the control group. The latter finding is inconsistent with previous studies and may be explained by spillover of the intervention to control colleges, other anti-tobacco activity in control colleges, and/or the small sample of dependent ST users enrolled in the study.

Key Words: intervention studies, randomized controlled trials, sports, oral snuff, chewing tobacco, substance abuse

The adverse health effects associated with the use of oral snuff and chewing tobacco, also known as spit (smokeless) tobacco (ST), include oral cancer,[1] oral leukoplakia[2,3] (a premalignant lesion[4]), cardiovascular disease,[5] periodontal disease,[6] dental caries,[7] and nicotine addiction.[8] Potent carcinogens have been measured in ST products, with levels of tobacco-specific nitrosamines 100-fold greater than the legal limits for nitrosamines in foodstuffs.[8] In addition, chronic exposure to nicotine delays wound healing.[9]

Athletes in the United States are at high risk for using ST and experiencing its associated adverse health effects.[10–12] In 2001, prevalence of ST use in the past 30 days reported among male National Collegiate Athletic Association (NCAA) athletes was as follows by sport: baseball, 41%; wrestling, 39%; ice hockey, 35%; lacrosse, 32%; football, 29%; golf, 27%; water polo, 25%; soccer, 20%; track and field, 17%; tennis, 13%; and basketball, 12%.[12] Researchers[13–15] have also documented that many collegiate and professional baseball athletes start using ST and purchasing their own ST products upon entering college or around 17 or 18 years of age. Despite

a formal NCAA ban in 1994 against ST use during games and practices,[16] no consistent intervention program to prevent initiation or to promote cessation of ST use among athletes has been established.

Several authors[17–19] reported that a baseball team-based intervention consisting of an oral-cancer screening examination with feedback, advice to quit, and brief counseling by a dental professional in the athletic facility promoted cessation of ST use. Unfortunately, these authors did not identify an effective infrastructure to sustain the intervention program nor did they assess the effect of the program on the initiation of ST use among baseline nonusers who participated in the team intervention. To address these omissions and the high prevalence of ST use among collegiate baseball athletes,[10–12] we conducted a study to evaluate the effect of training the certified athletic trainers (ATCs) to coordinate a team-based ST–use-intervention program in the collegiate athletic facility. Our purpose is to report the 1-year results of the effect of the ATC-mediated intervention on the initiation and cessation of ST use among collegiate baseball athletes.

METHODS

Design and Eligibility

We conducted a stratified, cluster-randomized controlled trial[20] to determine the effect of an ATC-directed ST intervention to prevent initiation and promote cessation of ST use among male collegiate baseball athletes in California. Sample-size calculations focused on cessation. Assuming an average of 13 ST users per college (based on our previous research with collegiate athletes),[17] 650 ST users (ie, 50 colleges) were required in order to detect a difference in proportions of 0.15 cessation in the intervention group versus 0.05 in the control group, with 90% power, using a 2-sided, .05-level chi-square test adjusted for clustering within colleges with an intracluster correlation coefficient of .02 (to account for peer influences and team dynamics on within-school cessation rates).[21] Colleges included in our study were selected randomly from a list of all California colleges with varsity baseball teams.

Recruitment and Informed Consent

To recruit colleges, we contacted ATCs in the randomly selected colleges to explain the study, obtain permission for their baseball athletes to participate, and ask for cooperation in obtaining informed consent and administering the baseline questionnaire. The ATCs were provided with detailed instructions and were to administer the baseline survey on 1 occasion to the entire team.

From January to March 1999, collegiate baseball coaches called meetings of players who were either trying out for or who had made the varsity or junior varsity baseball teams. At those meetings, the ATC explained the purpose, benefits, risks, and methods of the study; answered questions; and provided the toll-free number of a study investigator. In addition, the ATC assured strict confidentiality, emphasized that participation was voluntary and required team membership, distributed consent forms, and obtained informed consent from individuals interested in participating in the study. Many baseball coaches required that these team meetings be held during preseason try-out practices before the final team was selected because the preseason schedule could more easily accommodate these study activities. Once the roster of team players was finalized, the 4 individuals of 1589 who did not make the teams became ineligible for study participation and were excluded from the final study sample.

Baseline Assessment Procedures

At the team meeting described above and under the direction of the ATC, athletes enrolled in the study were given a baseline questionnaire to complete. Attached to the questionnaire was a face page, where name, current and permanent addresses, and telephone numbers were collected from each study participant, along with the names and addresses of 2 people who would know his whereabouts a year later. After completing this face page, athletes were instructed to separate it from the questionnaire and turn it in to the ATC before completing the questionnaire. The face page and the questionnaires were coded so that individuals could only be identified for follow-up by research staff.

To ensure confidentiality of questionnaire responses, an envelope was attached to each questionnaire and athletes were instructed to seal their completed questionnaires in the envelopes before returning them. In addition, a preaddressed, prepaid shipping box for athletes to deposit sealed envelopes with questionnaires was provided, and the last athlete to complete the survey was to seal the box so that it was ready to mail.

Randomization and Concealment

Prevalence of ST use was determined based on baseline questionnaire data. In order to obtain comparable numbers of ST users within each group, we stratified schools by tertiles of baseline questionnaire data on prevalence of ST use ($<$35.5%, 35.5–50%, $>$50%). Then, within strata and with equal probability, we randomized colleges (not individuals) to be in either the intervention or the control group because the ATC coordinated the intervention in colleges. This randomization would tend to balance both measured and unmeasured factors at the school level. Stratified cluster randomization was performed, stratifying on baseline prevalence tertiles using the SAS system (version 8.2; SAS Institute Inc, Cary, NC) to generate a pseudo-random uniform number for each school within each stratum. Schools, ATCs, and ballplayers did not know the group assignment until after agreeing to participate and completing the baseline assessment. Athletes in the intervention group received the study program, and athletes in the control colleges did not receive the program but were exposed to the usual antitobacco education offered at their colleges. All intervention materials, however, were distributed to the control colleges at the end of the study.

Follow-Up Assessment Procedures

Twelve months after randomization of colleges to intervention or control, study subjects were mailed a confidential follow-up questionnaire to determine their ST-use status. Two weeks later, nonrespondents were contacted by telephone and their questionnaires completed by telephone interview. After at least 3 unsuccessful telephone attempts to contact a subject within a 2-week period, which involved leaving a message and a toll-free number, the 12-month assessment was considered to be missing. In addition, at the end of the study, all ATCs were mailed a survey on their tobacco use and on their tobac-

co-control perceptions and activities to complete and return to study investigators.

Baseline Measures

The baseline athlete survey assessed demographic factors (ie, age, ethnicity), alcohol and lifetime tobacco use (cigarette, cigar, dip/chew: lifetime use for each substance, with 4 response options ranging from never to 100+), current ST-use status (defined as dip/chew use within the last 30 days), and type and brand of ST used. Patterns of use were assessed by items relating to frequency and duration of use, age of initiation (ie, age first began using ST regularly), and time after waking in the morning for the first dip/chew (within 30 minutes, within 3 hours, or more than 3 hours). Uses of ST within 30 minutes of waking[22] and frequency of ST use[23] have been reported to be measures of dependence in ST users.

In addition, the baseline athlete survey assessed previous quit attempts (yes/no), quitting self-efficacy (''How confidentare you that you can quit for good in the next 2–3 weeks?'' with 4 response options, ranging from *not at all* to *very confident*), current use of cigarettes, cigars, and alcohol (ie, number of days used in the last 30 days, with 7 choices from *none* to *all 30 days*); a 20-item modified Beck Depression Inventory score[24]; perceived risk of harm associated with ST use (4 response options ranging from *no risk* to *great risk* plus *not sure*); and perceived ST use by baseball coaches, assessed by asking each player to estimate the percentage of his baseball coaches who use ST.

To identify potential popular peer leaders to assist with intervention delivery, we asked the athletes to name 1 to 3 athletes on their team whom ''they admired and would like to be like.''[19,25] Peer-leader baseline ST use (based on the peer leaders' own baseline assessments) also was evaluated as a predictor variable.

Outcome Measures

A follow-up athlete questionnaire assessed ST, cigarette, and cigar use in the past 30 days (*yes/no*). The outcome of ST initiation was defined as self-report of ST use in the prior 30 days by a baseline ST nonuser at the 1-year assessment. The outcome of ST cessation was defined as self-report of no ST use in the last 30 days by a baseline ST user at the 1-year assessment.

Process Measures

On the 1-year follow-up athlete questionnaire, we assessed employment status and whether the athlete was still on a baseball team. In addition, for ST users, we assessed tobacco-cessation methods tried in the previous year. Choices were nicotine gum, nicotine patch, oral examination from dentist, advice and/or cessation counseling from ATC, counseling from cessation specialist, support from other players, support from partner or spouse, or other. For the analysis, these cessation methods were referred to as antitobacco items. The number of antitobacco items (0–3) was tallied for the following topics: (1) oral examination/dentist advice, (2) ATC advice/cessation specialist advice/counseling, and (3) nicotine replacement therapy (patch/gum).

Athletes in the intervention group were asked to identify the components of the intervention they attended. Those who participated in specific intervention components were asked to rate the helpfulness of each in preventing or quitting ST use (*very helpful*, *somewhat helpful*, *not at all helpful*).

Items on the 1-year follow-up survey of ATCs asked about their lifetime (*ever*) and current (*in the last 30 days*) use of snuff and chewing tobacco (*yes/no*). In addition, all ATCs were asked ''In the future, how likely are you to provide quitting advice and cessation information to players?'' and how likely are you ''to provide counseling on the use of nicotine replacement products for players who want to quit using ST?'' (5 choices from *not at all likely* to *very likely*).

Also, all ATCs were given a list of 3 sentences and asked to check the 1 that best described the effect participation in our study had on them (choices: *It enhanced my awareness of negative health effects of tobacco use and increased my tobacco preventive activities with athletes*; *It enhanced my awareness of negative health effects of tobacco use but did not change my interaction with athletes regarding tobacco use*; and *It has had no effect*). In addition, they were asked how supportive their baseball coaches were of ST–use-prevention activities (5 choices from *not at all supportive* to *extremely supportive*).

To assess ATC tobacco-control activities in the baseball environment during the study period, all ATCs were asked how often in the past year they advised ST users to quit, counseled ST users on quitting methods, referred ST users to an outside tobacco-cessation counseling program, and provided players with written materials on the risks of ST use and ways to quit (4 choices from *never* to *frequently*). In addition, they were asked how comfortable they felt helping athletes with tobacco cessation (*very*, *somewhat*, *not at all*). All ATCs were specifically asked if their colleges provided an oral (mouth) examination of athletes as part of their annual health screenings during the previous baseball season. Those who responded *yes* were asked to estimate the percentage of the baseball team that participated and how helpful the oral examination was in discouraging the use of tobacco (5 choices from *not at all helpful* to *very helpful*).

Also, all ATCs were asked how addictive they thought ST was (5 choices ranging from *not at all addictive* to *extremely addictive*) and to identify major obstacles to advising players against tobacco use (10-item checklist).

To assess processes related to intervention delivery, ATCs in the intervention group were asked if they received ST cessation training from the videoconference (*yes/no*); if they or their designee prepared peer leaders to conduct a team meeting on ST (*yes/no*); and if, as part of the study, tobacco-cessation counseling was offered to baseball players (*yes/no*). Finally, for each component of the intervention, they were asked if it was important to be included as part of a national program for all athletes (*yes*, *somewhat*, *not really*) or if it was *negative and turned me off* (*yes*, *somewhat*, *not really*).

The Intervention

After randomization, we contacted collegiate athletic directors and ATCs at the 27 intervention colleges to schedule the intervention.

Theoretic Framework

The intervention reported in this study was based on diffusion of innovation theory[26] and cognitive social learning the-

ory.[27] Diffusion of innovation theory maintains that changes in norms and behavior are often initiated by a relatively small segment of opinion leaders in a population. This theory posits that, once an innovation is visibly modeled and accepted by natural opinion leaders in the population, the innovation then diffuses throughout the population.[26] We applied this theory by recruiting peer leaders to endorse noninitiation of ST use among their fellow athletes at a meeting in an attempt to change social norms to promote nonuse of ST. We also tried to create an environment supportive of nonuse of ST by intervening on the entire team in their athletic facility.

In promoting behavior change, cognitive social learning theory[27] emphasizes the importance of knowing how to behave (competency); believing one can perform the desired behavior (perceived self-efficacy); and believing that, if the behavior is implemented, it will achieve the desired outcome (outcome expectation). The brief counseling by the dental hygienists and follow-up by the ATC to assist those who wanted to stop using ST was meant to provide skill training and support to enhance feelings of competency, self-efficacy, and outcome expectation. The desired behavior was reinforced by the ATC, who provided ongoing support and motivation for remaining tobacco free.

Components

The intervention, developed based on feedback from 2 focus groups (1 in Northern California and 1 in Southern California) of 8 college ATCs each and pilot tested in 2 colleges not included in the final study sample, consisted of 4 components:

1. **Videoconference and Follow-Up Newsletter.** A 3-hour videoconference was conducted on the study protocol, highlighting state-of-the-art ST cessation treatment (January 2000). This videoconference served to train the ATCs as well as dentists and dental hygienists associated with the intervention colleges. Training manuals were developed and distributed. The videoconference was broadcast from West Valley Community College in Saratoga, California, to 3 other host community colleges across the state. Speakers at the videoconference included Joe Garagiola, former Major Leaguer, National Baseball Hall of Fame Broadcaster, and current Director of the National Spit Tobacco Education Program; Gloria Tuttle, an advocate who described the devastating effects oral cancer has had on her family; and experts on adverse health effects of ST use and on cessation. As incentive for participation, we offered 3 continuing education credits at no cost to the attendees. A follow-up newsletter reinforcing videoconference information was sent to all intervention ATCs. A videotape of the conference was sent to 2 ATCs unable to attend the conference and telephone follow-up provided.
2. **Dental Component.** During the preseason health screenings mandated for collegiate athletes in California, the ATC coordinated the provision of an oral-cancer screening examination for each member of the baseball team by a dentist and/or a dental hygienist from the local community. At the time of the screening, the examiners encouraged ST nonusers to remain tobacco free and advised ST users to stop all forms of tobacco ingestion. In addition, for ST users, examiners pointed out any problems associated with ST use in players' own mouths, provided a self-help guide for quitting ST use tailored to baseball athletes,[28] and offered single 10- to 15-minute individual sessions of ST-cessation counseling that day. This brief counseling was provided by a specially trained dental hygienist and focused on reviewing the addictive nature of ST, setting a quit date, developing a plan, and training in action and thinking skills to get ready to quit and prevent relapse.
3. **Certified Athletic Trainer Follow-Up and Referral.** Follow-up of ST users trying to quit was conducted by the ATC on the scheduled quit date and in 3 group booster sessions scheduled 1 week apart. For example, if an athlete had not yet quit on his quit date, then the ATC reviewed the advantages and disadvantages of quitting with him in an attempt to facilitate a decision to make a quit attempt.[29] In general, ATCs expressed concern, reminded athletes that most individuals had to try several times to stop tobacco use before they were successful, and provided support for the quitting process. In group sessions, if an athlete reported he had quit and was abstinent, then the ATC asked him to share with the group his successful coping strategies to prevent relapse. If an athlete reported he had tried unsuccessfully to quit, then the ATC facilitated group discussion to help problem solve about what could have been done differently to prevent the slip or relapse. In addition, the ATC referred athletes wishing more intensive support and problem solving to tobacco-cessation counselors on campus or in the community.
4. **Peer-Led Component.** Student-athlete peer leaders, who were identified on the baseline questionnaire by teammates as people they admired, conducted an educational session for the entire team. The peer-led component consisted of a single, interactive, 50- to 60-minute educational team meeting at the college that had 3 components: a 5-minute video tailored to baseball athletes entitled *Dangerous Game: The Truth About Spit Tobacco,*[30] 10 slides (20–30 minutes) that included graphic pictures of facial disfigurement due to oral cancer; and a 20-minute video entitled *A Tragic Choice: The Bob Leslie Story*.[31] After each component, peer leaders asked the group specific questions to stimulate discussion. Peer leaders also stated that whether or not one used ST was a personal decision but that the purpose of the meeting was to help everyone make an informed personal choice. Several groups[32–34] have found peer-led smoking and drug–abuse-prevention programs to be significantly more successful in reducing onset and use rates than the same programs taught by teachers or other nonpeers.

Recruitment and Training of Dental Professionals and Peer Leaders

The ATCs and study investigators recruited dental professionals from study communities by either calling dentists the ATCs knew personally or by calling local professional dental societies. Dental professionals who agreed to participate in the study were trained in the study protocol during the taped 3-hour videoconference also attended by the ATCs. For this training, they received 3 continuing education credits at no cost. Three dentists and dental hygienists in 3 practices were unable to attend the videoconference but were given a videotape of the training videoconference and a training manual to review. Subsequently, they met individually with a study investigator to discuss the main points and to address questions about the study protocol. All dental professionals were observed by study personnel on intervention days to assess compliance with the study protocol. The dental professionals were

assigned to their local colleges in teams of 1 dentist and 2 dental hygienists per college based on schedule availability.

In each intervention school, the ATC recruited at least 2 or 3 peers from a list of athletes identified on the baseline questionnaire to lead the educational team-meeting component of the intervention. Peer leaders were trained, under the supervision of the ATC, by viewing a training videotape and reading a training manual provided by study investigators. As an incentive for participation and as a thank you, each peer leader received an individual letter, written by the principal investigator of the study, to support an application for employment or graduate school.

Data Analysis

We compared the distribution of baseline characteristics in the intervention and control groups. Characteristics were aggregated to the collegiate level as a means for baseline analyses to properly account for the number of randomization units (52). To avoid inflating the type I error (alpha) by performing many individual tests, a global test of baseline homogeneity between the groups was performed. The test used a global score statistic from a generalized estimating equations (GEE) model (logit link, exchangeable correlation, binomial variance, cluster = college) with group assignment as the response and baseline characteristics as the predictors.[35] Baseline balance at randomization was assessed in terms of age, race (white, Latino, or other), lifetime cigarette use, lifetime cigar use, lifetime ST use, monthly cigarette use, monthly cigar use, monthly alcohol use, monthly ST use, perceived ST-use harm, perceived percentage of coach ST users, mean Beck Depression Inventory score,[24] and number of peers identified who were ST users.

Outcome Analyses

We analyzed ST users and nonusers separately to examine the effect of the intervention on the rates of ST initiation and ST cessation. For the outcome of ST initiation, we analyzed only baseline ST nonusers (never users, tryers, and former users), whether or not they were followed up (intention-to-treat analysis). For analysis, when responses were missing, we coded subjects as noninitiators, consistent with last-observation-carried-forward imputation.[36] For analysis of the outcome of ST cessation, we included every baseline ST user, whether or not he was followed up (intention-to-treat analysis). Those lost to follow-up were counted as nonquitters (ie, assumed to still use ST at 1 year), consistent with last-observation-carried-forward interpretation.[36] For athletes who reported they had attempted to quit, frequencies of responses regarding strategies used were compared between study groups.

We tested the 2 null hypotheses of no intervention effect using logit GEE (SAS proc genmod with repeated statement; SAS 8.2[37]) adjusted to account for cluster randomization.[20,38] We estimated the intervention effects via odds ratios (ORs) and 95% confidence intervals (CIs) adjusted for clustering within colleges. To examine whether missing responses occurred at random, we used a logit GEE model with lost to follow-up as the response and baseline measures as predictors.

Prediction Analyses

Spearman correlation and regression diagnostics were used to assess potential collinearity (intercorrelation) among predictors. If collinearity existed, centering and principal-components analyses were used to create variables for modeling. To avoid collinearity among substance-use predictors (ie, lifetime tobacco and monthly alcohol use), principal-component analysis was used to reduce these 4 potential predictors to 1 uncorrelated factor (lifetime substance principal component). To facilitate interpretation, this principal component was reverse scored. Six ordinal or dichotomous items from the ATC 1-year follow-up survey (ie, advise to quit ST use, counsel on quitting, refer to expert or program, provide written materials on ST risks, provide written materials on ways to quit, and advise to quit cigarette use) were intercorrelated and reduced to 3 independent factors via principal-component analysis using a varimax orthogonalization rotation.

To determine baseline and follow-up factors (ie, employment, playing baseball at 1 year, number of antitobacco items, percentage of peer users, and ATC-level variables) related to ST initiation and ST cessation, GEE (logit link function, binomial variance, and exchangeable correlation structure) models with backward elimination adjusted for colleges as clusters were used. These models assessed effects that had significant Spearman correlations and all ATC-level effects because Spearman correlations may miss such cluster-level effects.

Process Assessments

Intervention-group athletes and ATCs were assessed for participation in each intervention component. For those athletes who participated in specific intervention components, the percentage of athletes who rated each intervention component as helpful was determined. Also, intervention-group ATCs were assessed for participation in each component and those participating were asked if they thought it was important to include that component in a national program for all athletes.

Moreover, for all ATCs who responded to the 1-year follow-up survey, the percentage of ATCs who reported various antitobacco activities during the study period was determined. Finally, the percentage of ATCs reporting various effects that study participation had on them with regard to tobacco control was determined.

RESULTS

Of 87 California colleges contacted, 59 (68%) agreed to participate in the study. Of the 59 colleges that agreed to participate in the study, 6 were dropped before randomization because they failed to return the baseline questionnaires; 1 was dropped after randomization due to anticipated contamination of its randomly assigned control status because it was the site of the broadcast videoconference. The stratified randomization yielded an unequal number of schools per group (25 control and 27 intervention colleges) but similar numbers of subjects per group (285 and 352 ST users and 417 and 531 nonusers in the intervention and control groups, respectively).

Of 1970 eligible athletes on the baseball teams, 385 either declined participation or were excluded because they were absent on the day of the baseline assessment. Thus, 1585 (80%) were enrolled in the study. Across colleges, on average, 81% of team members participated (range, 45–100%). One-year follow-up surveys were completed by 1248 athletes for a 79% response (intervention = 78.7%, control = 78.8%). Fewer than 1% refused, and 20% were lost due to wrong or incomplete contact information.

Table 1. Study Subject Demographics and Other Characteristics (N = 1585)

Characteristics		Percentage	n
Age (y)			
17, 18		34	534
19, 20		50	777
>20		16	254
Ethnicity			
White		70	1113
Latino		17	266
Asian		4	62
Black		3	52
Multiethnic		2	31
Native American		2	26
Not stated		2	35
Substance use*			
Spit (smokeless) tobacco			
Ever		71	1119
Past 30 d		40	637†
Daily‡		11	179
Cigarettes			
Ever		59	934
Past 30 d		20	310
Daily‡		1	15
Cigars			
Ever		72	1123
Past 30 d		16	249
Daily‡		<1	2
Alcohol			
Past 30 d		73	1145
Daily‡		<1	6
Perceptions related to spit (smokeless) tobacco use			
Risk of harm			
None/slight		10	139
Moderate		45	653
Great		45	658
Belief that coach uses spit (smokeless) tobacco		83	1289
Negative mood (Beck Depression Inventory scores)			
None (0–9)	Mean < 0.5	52	797
Mild (10–18)	Mean = 0.5–0.9	34	526
Severe (>18)	Mean > 0.9	14	208

*Categories are not mutually exclusive.
† Indicates 431 who did not smoke cigarettes in past 30 days.
‡ Indicates used at least 22 times in the last 30 days.

Loss to follow-up was assessed with a global score statistic (multiple degrees of freedom) to address multiple comparisons issues (ie, more testing could yield statistical significance just by chance). Factors in the lost-to-follow-up model included age, race, substance-use principal component, alcohol use in the last 30 days, baseline ST use, perceived harm of ST use, estimated percentage of team using ST, estimated percentage of coaches using ST, mild and moderate depressive symptoms (ie, Beck Depression Inventory scores),[24] and randomized group. The chi-square value was 16.7 with 11 degrees of freedom, which was nonsignificant ($P = .12$); however, because it was suggestive of significance, the individual factors in the model were examined with race (white versus nonwhite) and coach ST use being the only factors with $P \leq .05$. Most important, randomization group was not significant. Seventy-six percent (482/637) of ST users and 81% (766/948) of nonusers completed the 1-year follow-up (nonsignificant after adjusting for multiple comparisons). Sixty-one percent of 1-year follow-up questionnaires were completed via telephone interview (63% of ST users and 60% of ST nonusers). Follow-up response with baseline ST users was similar in the intervention and control groups (75.6% versus 75.8%, respectively).

Table 2. Baseline Prevalence of Past 30-Day Spit (Smokeless) Tobacco Use

	Percentage of Spit (Smokeless) Tobacco Use	n*
Overall	40	637
Ethnic group		
White	42	470
Asian	37	25
Latino	36	101
Native American	35	9
Multiethnic	37	6
Black	17	9
Not stated	52	17
Substance use		
Alcohol users (past 30 days)	49	561
Smokers (past 30 days)	66	206

*Indicates number of spit (smokeless) tobacco users within group.

Baseline Characteristics

Most of the athletes were between 17 and 20 years of age and white (Table 1). Forty percent (637) reported ST use in the past 30 days, with 11% (179) also reporting daily ST use. With regard to smoking and alcohol use, no more than 1% smoked on a daily basis and fewer than 1% reported daily alcohol use. Ninety percent of athletes perceived moderate or great harm associated with ST use, and 83% believed that at least one of their baseball coaches used ST. Eighty-six percent of these athletes reported no or mild symptoms of negative mood based on Beck Depression Inventory scores. A global GEE score test to predict randomization group from baseline measures showed no significant baseline imbalance (GEE score test = 16.3, 16 degrees of freedom, $P = 0.429$).

Spearman correlation matrices indicated that lifetime tobacco use (cigarette, cigar, and dip/chew) and monthly alcohol-use variables, measured on ordinal scales, were not only related to baseline dip/snuff use but also were intercorrelated. The principal component of substance use accounted for 59% of the variation of the 4 substance-use factors and was correlated from .77 to .80 with the 3 lifetime tobacco-use measures and at .72 with the monthly alcohol measure.

Baseline prevalence of current ST use was highest among the white (non-Hispanic) ethnic group (42%) and lowest among black (17%) ethnic groups (Table 2). Sixty-six percent of smokers and 49% of alcohol drinkers also used ST. In addition, ST users used both snuff and chewing tobacco, used more than 30 minutes after waking, and were very confident that they could quit using ST if they so wished (Table 3). The mean age at which ST use was first tried was 15.6 ± 2.5 years (median = 16 years). The mean age at which ST was first used regularly was 17.1 ± 1.9 years (median = 17 years).

Table 3. Characteristics of Baseline Past 30-Day Spit (Smokeless) Tobacco Users (n = 637)*

Characteristic	Percentage	n
Type		
Snuff	33	208
Chewing tobacco	20	126
Both	48	303
First spit (smokeless) tobacco use after waking		
≤30 min	7	36
>30 min	93	469
Self-efficacy		
Not at all/a little	28	111
Somewhat	26	138
Very	53	280
Previous quit attempt	43	222

*May vary due to missing data, and percentages may not add to 100% due to rounding.

Table 4. Self-Reported Initiation Rates and Intervention Effect (N = 948)

Group	N	Percentage	n	Odds Ratio	95% Confidence Interval
Control	417	8.4	35		
Intervention	531	5.1	27	0.58	0.35–0.99

Initiation of Spit (Smokeless) Tobacco Use: Effectiveness of the Intervention

One-year follow-up results indicated initiation of ST use was 5.1% at intervention colleges and 8.4% at control colleges when we assumed that nonrespondents were noninitiators. The overall GEE OR measuring the intervention effect for initiation was 0.58 (95% confidence interval [CI] = 0.35–0.99), adjusted for clustering of responses within schools (Table 4). This finding was statistically significant and indicates that baseball players in the intervention colleges were 42% less likely to initiate ST use than players in the control colleges. Intraclass correlation among the 52 schools for noninitiation at 1 year among baseline nonusers was .0074, as estimated with SAS.

Predictors of Noninitiation

Six items from the ATC 1-year follow-up survey were reduced to 3 independent factors or principal components that explained 75% of the variation. One principal component mostly reflected written materials on health risks (correlation =.66) and on ways to quit (.85). Another principal component mostly reflected advice to quit ST use (.74), advice to quit cigarette use (.85), and counsel to quit ST use (.56). The last principal component reflected refer (.81) and counsel to quit ST use (.37).

Spearman correlation matrices indicated statistically significant associations between ST noninitiation among baseline nonusers and the following characteristics: low lifetime substance-use principal component, percentage of 1–3 peers listed who self-reported ST use at 1-year follow-up, ATC's perception of coach's support of ST–use-prevention activities, ATC sex, and number of ATC self-reported tobacco-control activities. The final multivariable model results are presented in Table 5. Adjusting for covariates did not change the findings comparing intervention versus control colleges with GEE models.

Table 5. Predictors of Noninitiation: Multivariable Generalized Estimating Equations Model (N = 948)*

Baseline Characteristic	Odds Ratio	95% Confidence Interval	*P*
Low substance-use principal component†	1.98	1.40–2.82	<.001
Certified athletic trainers: high coach support for spit (smokeless) tobacco prevention	1.43	1.11–1.83	.005

*Candidate variables used in prediction model: age, race/ethnicity, depression (Beck Depression Inventory), number of teammates who responded, number of peer names, work indoors, certified athletic trainers' 30-day spit (smokeless) tobacco use, play baseball at 1 year, no certified athletic trainers survey, certified athletic trainers: coach supports spit (smokeless) tobacco-use prevention, certified athletic trainers: intervention effect, certified athletic trainers: frequently counsel those trying to quit spit (smokeless) tobacco, certified athletic trainers: frequently advises players to stop/reduce spit (smokeless) tobacco, certified athletic trainers' score, certified athletic trainers male, and certified athletic trainers' comfortable advising.
†Lifetime tobacco and monthly alcohol use principal component, reverse scored.

Cessation of Spit (Smokeless) Tobacco Use: Effectiveness of the Intervention

Overall, ST cessation was 36% in the intervention group and 37% in the control group (GEE OR = 0.94, 95% CI = 0.70–1.27). More frequent baseline ST use (at least 22 of the prior 30 days) was a significant effect modifier as assessed by the interaction between group and a baseline measure of nicotine dependence (GEE $P = .041$). Effect modification means the treatment effect differs (in direction or degree) in subgroups that are best tested with interaction terms in clinical trials to avoid overidentifying subgroups. Because the interaction was significant, the treatment effect was assessed separately in the subgroups. Among more frequent baseline ST users (ie, those who used ST on 22 or more days in the previous 30 days), ST cessation was 22% in the intervention and 20% in the control group (GEE OR = 0.68, 95% CI = 0.30–1.56). Among less frequent baseline ST users, the GEE OR was 1.2 (95% CI = 0.82–1.54), indicating no significant difference in ST cessation between the groups or in the subgroup analysis for nicotine-dependent baseline ST users. Intraclass correlation among the 52 schools for cessation at 1 year among baseline users was .0197, as estimated with SAS proc mixed. (Note that sample-size calculations for the study assumed an intraclass correlation of .02.)

Of the 431 exclusive ST users at baseline, 18 (4%) reported at follow-up that they had stopped ST use but had smoked at least 1 cigarette in the previous 30 days. Of the 206 baseline ST users who also smoked cigarettes, 29 (14%) reported at follow-up that they quit ST use but continued to smoke.

Predictors of Spit (Smokeless) Tobacco Cessation

Spearman correlation matrices also indicated statistically significant associations between ST quitting among baseline

Table 6. Predictors of Cessation: Multivariable Generalized Estimating Equations Model*

Characteristic	Odds Ratio	95% Confidence Interval	*P*
Self-efficacy	1.40	1.01–1.94	.047
First spit (smokeless) tobacco use after waking (>3 hours)	2.95	1.49–5.82	.002
Play baseball at 1 year	0.39	0.22–0.68	.001
Number of antitobacco items	0.30	0.22–0.41	<.001
Certified athletic trainers 30-d spit (smokeless) tobacco use	0.54	0.36–0.82	.004
Certified athletic trainers often counsel	0.57	0.36–0.88	.012

*Candidate variables used in prediction model: age, race/ethnicity, depression (Beck Depression Inventory), substance-use principal component, branch nicotine content, addiction score [first spit (smokeless) tobacco < ½ hour + 0.5× (½ hr < first spit (smokeless) tobacco < 3 hours) + more morning spit (smokeless) tobacco use + hard to refrain where forbidden + hardest to give up first morning use + use spit (smokeless) tobacco when ill + brand higher nicotine content + 3× (use >15×/d + 2× (use 10–15×/d) + (use 1–9×/d)], highly addicted (addiction score >3), more addicted (addiction score > median 2), age of first spit (smokeless) tobacco use, first spit (smokeless) tobacco use after waking, use where forbidden, number of teammates who respond, self-efficacy with regard to quitting, number of peer names, work indoors, number of antitobacco items, certified athletic trainers' 30-day spit (smokeless) tobacco use, play baseball at 1 year, no certified athletic trainers survey, certified athletic trainers: coach supports spit (smokeless) tobacco-use prevention, certified athletic trainers: intervention effect, certified athletic trainers: frequently counsel those trying to quit spit (smokeless) tobacco, certified athletic trainers: frequently advise players to stop/reduce spit (smokeless) tobacco, certified athletic trainers' score, certified athletic trainers male, and certified athletic trainers' comfort advising.

users and the following characteristics: substance-use principal component, dip/chew nicotine content (brand), age ST first tried, first ST use of day, hard not to use ST where forbidden, confidence to quit, number of teammate respondents, number of peers reported to be admired who were ST users, play organized baseball at 1-year follow-up, ATC 30-day ST use at 1-year follow-up, work indoors, and number of self-reported antitobacco components.

Results from the final multivariable model (GEE model with backward elimination of the possible predictors) are presented in Table 6. Level of self-efficacy with regard to quitting, the number of antitobacco components received, whether or not the ATC used ST, and whether or not one played baseball at 1 year were significant predictors of ST cessation. One extra self-efficacy level increased the likelihood of cessation by 1.4 times (ie, feeling *moderately confident* about being able to quit compared with *not at all* or *slightly confident* increased the likelihood of cessation by 1.4 times). One extra antitobacco item decreased odds of cessation by more than 3 times (1/0.30 = 3.28). The ATC 30-day ST use and ATC reporting that he/she counsels often each decreased cessation by about 1.8 times. Playing baseball 1 year later decreased the likelihood of cessation by more than 2.5 times. Adjusting for covariates did not change the findings comparing intervention versus control colleges with GEE models.

Process Assessment: Intervention

Of 883 baseline athletes and 27 ATCs in the intervention group, 692 (78%) and 23 (85%), respectively, provided information regarding participation in and perceived helpfulness of program components on the 1-year follow-up questionnaire. More than half of the intervention-group athletes attended the peer-led educational session, received an oral-cancer screening examination including advice to quit or to remain tobacco free, and received printed educational materials (Table 7). At least 75% of these participating athletes perceived these activities as helpful. Although not shown in Table 7, 66% of ST nonusers and 71% of ST users in the intervention group received an oral examination.

Among the 264 ST users in the intervention group, only 14% (36) sought individual counseling on how to quit ST use. Of those athletes, 20% of daily users (15/74) sought counseling, compared with 11% of nondaily users (21/190). In addition, among the 261 intervention ST users with data on time after waking for first use of ST, 27% (4/15) of the nicotine-dependent users (ie, used ST within 30 minutes of waking)[22,23] received counseling compared with 13% (31/246) of non–nicotine-dependent ST users (ie, no ST use within 30 minutes of waking). Among all athletes who received cessation counseling, 89% perceived it as helpful. In general, most respondents who participated in the intervention components rated them as helpful in learning about ST (see Table 7).

Ninety-six percent of intervention-group ATCs (n = 23) attended the video conference, the oral examinations of the team members, and the peer-led videotape presentations; how-

Table 7. Process Assessments of Intervention-Group Athletes Related to Intervention Participation and Perceived Helpfulness of Program Components (n = 692)

	Percentage Attended	n	Percentage Perceived Helpful	n
All subjects (users and nonusers)				
Videos				
Dangerous Game: The Truth About Spit Tobacco	66	454	96	432
A Tragic Choice: The Bob Leslie Story	62	426	96	409
Slides of oral cancer	60	413	94	367
Oral examination by dentist	68	469	80	370
Material on how to quit spit (smokeless) tobacco	58	397	75	291
Peer-led educational meeting	55	379	89	336
Users only (n = 264)				
Individual counseling on how to quit	14	36	89	32

Table 8. Percentage of Certified Athletic Trainers (n = 48) by Group Reporting Tobacco-Control Activities During the Study Period, Perceived Effect on Themselves from Study Participation, and Other Spit (Smokeless) Tobacco-Related Perceptions

Activities/Perceptions	Intervention (n = 25*)		Control (n = 23*)	
	Percentage	n†	Percentage	n†
Advice				
Sometimes or frequently performed	92	22	87	20
Cessation counseling				
Sometimes or frequently performed	63	15	30	7
Cessation referral				
Sometimes or frequently performed	8	2	9	2
Educational materials provided				
Risk related	96	23	70	16‡
Cessation related	83	20	39	9§
Oral cancer screening	100	25	17	4§
Effect of study participation				
Changed knowledge, attitudes, and practices	68	17	26	6
Changed knowledge, attitudes	20	5	52	12
No effect	12	3	22	5
Other spit (smokeless) tobacco-related perceptions				
Felt comfortable advising	58	14	52	12
Thought spit (smokeless) tobacco very addicting¶	100	24	96	22
Planned to offer cessation advice and information in the future¶	83	20	43	10
Planned to offer counseling on nicotine replacement therapy in the future¶	67	16	39	9

*Indicates loss to follow-up of 2 certified athletic trainers in each group.
†Indicates n may vary due to missing data.
‡Indicates chi-square $.01 < P \leq .05$.
§Indicates chi-square $P \leq .01$.
¶Indicates very likely.

ever, only 70% were present for the individual counseling and 74% for the peer-led meetings. Almost all ATCs attending intervention components rated them as important and thought they should be included in a nationwide tobacco-control program for all athletes (range, 93–100%).

Tobacco-Control Activities of ATCs in Both Groups

Of the 52 ATCs participating in the study, 48 (92%) completed and returned a 1-year follow-up survey. Intervention-group ATCs performed more tobacco-control behaviors with their athletes during the study period than control-group ATCs (Table 8). Nevertheless, an unexpected percentage of control-group ATCs provided cessation advice (87%), educational materials on risks related to ST use (70%), cessation materials (39%), and cessation counseling (30%). In addition, 17% of control-group ATCs reported that their athletes received an oral examination as part of the preseason health screening; 26% reported that participating in the study caused them to change their ST-related knowledge, attitudes, and practices; and almost half (43%) planned to offer ST cessation advice, information, and counseling in the future. More than half (68%) of all ATCs reported players' resistance to cessation advice and assistance were major obstacles to ATC tobacco-control activity (Table 9).

Table 9. Barriers to Tobacco-Control Activities Reported by Certified Athletic Trainers (n = 48)

Barrier	Percentage Checking Statement
Player resistance	
Players resist advice to quit during the baseball season	68
Players resist referral to cessation clinics or self-help programs	66
Tobacco use is not a very important concern of players	28
I am pessimistic about people's abilities to change their tobacco use	11
Lack of skills and information	
I am not aware of appropriate spit (smokeless) tobacco-cessation services	32
I need further training to treat tobacco use	26
Too few services to which players can be referred	26
Lack of coordination between certified athletic trainers and tobacco-cessation services	23
Lack of time	
I have too little time to treat these problems	13
Lack of appropriateness	
I believe that intervention is often not appropriate because tobacco use is a matter of personal choice	4

DISCUSSION

Male collegiate athletes are heavy users of ST and are at high risk for adverse health effects associated with ST

use.[1–12] The high prevalence of current ST use (40%) among collegiate baseball athletes in this study despite an NCAA ban[16] highlights the dire need for effective interventions.

Our statistically significant findings indicate that the baseball athletes at the intervention colleges were 42% less likely to initiate ST use than the baseball athletes in the control colleges. This ''prevention of ST use'' effect may be looked at as modest; however, when viewed in light of the high risk of ST use among males who play collegiate baseball[10,11,17] and other collegiate sports[12] and in light of the relative acceptability and feasibility of the intervention, this effect could have an enormous impact on the health of student-athletes in US colleges if the program is adopted nationally. Our study was designed to evaluate the effectiveness of a best-practices, multicomponent intervention against a usual care-control condition. Further research is needed to examine the efficacy of separate components to determine which were important in mediating the prevention effect of the intervention.

Overall, the strongest predictor of noninitiation of ST use was the principal component low lifetime use of tobacco and low use of alcohol in the last 30 days. Collegiate baseball players with a lower substance-use principal component were about twice as likely to remain ST nonusers. This finding is not surprising based on evidence that ST use is associated with smoking and alcohol consumption.[39–42]

Another significant predictor of noninitiation of ST use was reporting by the ATC that the baseball coach was supportive of ST–use-prevention activities. Baseball players on collegiate teams for which the ATCs reported the baseball coach supported ST–use-prevention activities were more likely to remain ST nonusers than players on teams whose coaches did not support ST–use-prevention activities. This finding emphasizes the importance of baseball-coach support for tobacco-control activities in athletic facilities and suggests that the baseball coach is an important role model for baseball athletes. Future researchers should study the effect of an intervention that targets baseball coaches on their athletes' ST-use initiation and cessation behavior.

Despite a significant intervention effect on ST-use initiation (incidence), the intervention, as delivered, had no effect on ST-use cessation. The percentage of athletes who quit ST use was similar in both groups and much higher (37%) than expected in the control group based on similar studies in the literature.[17,19,43,44] This inconsistent finding could not be due to seasonal use because follow-up was conducted 1 year from baseline; however, it may be explained by several other issues. First, the study schools were from a limited geographic region (ie, California only), where a tobacco tax supports antitobacco education and, in general, there is a focus on a healthy lifestyle. These cultural influences may have affected the perception of athletes regarding the importance of stopping ST use to protect their health.

Also, the definition of cessation as an outcome in this study was somewhat strict and may partially explain why this intervention did not prove effective for ST cessation. For example, a student-athlete may have reduced his use of ST from 3–4 times per day at baseline to 1–2 times per week at follow-up. Although this reduction would be a significant and desired change in behavior, it was not taken into account as a study outcome.

Moreover, the lack of a cessation effect may be due to the small number of nicotine-dependent ST users in the study, as suggested by the findings that only 11% of ST users used ST daily, only 7% used it within the first 30 minutes of waking,[22,23] and more than half (53%) felt very confident that they could quit if they decided to do so. This explanation is supported by our overall findings that a baseball athlete was more likely to quit if he had his first dip or chew later in the day, had confidence that he could quit if he decided to do so, and did not engage in antitobacco activities (eg, did not use nicotine replacement, did not receive cessation counseling from the ATC or a cessation specialist, and did not seek support from family and friends). The latter finding related to not engaging in antitobacco activities is consistent with the explanation that ST users who are less dependent on nicotine would have less difficulty with the quitting process and, consequently, would tend not to use nicotine-replacement products or seek cessation counseling and social support as much as nicotine-dependent ST users. We speculate that the reason only 14% of ST users in the intervention group sought individual cessation counseling was that only a small percentage of users were dependent on ST and felt they really needed help to quit. This explanation is consistent with our findings that more frequent users of ST in the intervention group tended to seek counseling more often than less frequent users.

Also, it is important to note that there was a modest but statistically significant cessation interaction effect between being a more frequent ST user (ie, those who used ST on 22 or more days in the previous 30 days) and being in the intervention group. Unfortunately, we did not have a large enough sample of more frequent ST users (ie, dependent users) in our study to find a cessation intervention effect in that subgroup. Further study of our intervention needs to be conducted in a large sample of heavily dependent ST users. These findings could be important for tailoring the choice of subjects and delivery of this type of intervention in this setting.

In previous studies of high school and collegiate athletes in whom a similar intervention was tested, 1-year cessation rates ranged from 27 to 35% in the intervention groups and 14 to 16% in the control groups.[17,19] Unlike our study, however, those studies included larger samples of addicted ST users who may have found it more difficult to quit ST use spontaneously and saliva samples were collected to validate self-reported quitting of ST use.

Moreover, the discrepancy between control-group cessation rates in previous studies[17,19] and our study may be due to spillover of the intervention to control colleges (ie, contamination of the control group with intervention information). California's ATCs are a very tight-knit group. The ATCs in control colleges may have heard about the contents of the videoconference or seen the newsletter, especially given the high profile of some of the videoconference presenters and the enthusiastic support provided for the study by the California Athletic Trainers' Association. The possibility of spillover of intervention information into the control condition is supported by our unpublished findings of a survey we conducted 1 year earlier. In that survey, we assessed 56 randomly selected California collegiate baseball ATCs and found that only 14% provided tobacco-cessation counseling to their ST-using athletes. In contrast, 30% of our control-group ATCs reported they sometimes or frequently counseled players on methods to quit ST use during the study period.

Unlike authors of previous ST-cessation studies with athletes,[17,19] we relied on ATCs to gain informed consent and to administer and return the baseline questionnaires. In doing so, we may have sensitized control-group ATCs to the problem

and the intervention protocol. This explanation is supported by the fact that 52% of ATCs in our control colleges reported on the 1-year questionnaire that participation in the study changed their knowledge and attitudes about ST use, and an additional 26% reported their study participation changed their knowledge, attitudes, and behavior. Thus, the effect of study participation on the control-group ATCs may explain the high cessation rate in the control group. Investigators in future community-based studies need to consider research designs other than the one we used to prevent control-group contamination with aspects of the intervention and to assess such spillover of the intervention. For example, the Solomon 4-group research design[45] allows the assessment of the effect of study pretesting (eg, administration of the baseline survey) on study outcome. In that 4-group design, 2 groups (1 intervention and 1 control) are pretested and posttested and the other 2 (also 1 intervention and 1 control) are only posttested.

High quit rates in the control group also may be explained in part by the fact that the 59 ATCs who agreed to participate in the study may have been more interested and active in ST cessation than the 27 ATCs who refused to participate. This ATC interest combined with possible spillover and the low level of nicotine dependence among ST users in both groups may explain why the quit rates in both groups were similar and higher than those reported in other ST–use-cessation studies.[17,19,43,44]

Regarding loss to follow-up, nonwhites and players who perceived more coach ST use were more likely to drop out of the study. However, no differential dropout was seen between the intervention and control groups. Moreover, loss to follow-up was somewhat high at about 20%. Intent-to-treat principles were used with a last-observation-carried-forward approach.[36] Additional analyses with other imputation approaches (complete data only—same as missing at random, dropouts as users, or dropouts as nonusers) revealed consistent results with regard to noninitiation and cessation-intervention effects.

Our study successfully delivered the intervention because the ATCs incorporated it into the baseball athlete program. In addition, findings showed that most ATCs and athletes in the intervention group found the program to be valuable. Only a few ATCs failed to return their questionnaires. Although it is possible that more enthusiastic ATCs returned their questionnaires, the major factor accounting for nonreturn was probably competing demands on ATCs' time. It is unlikely that the response related to acceptability of the intervention components was severely biased, but we cannot exclude this possibility.

Nevertheless, our data suggest we delivered an intervention that was acceptable to collegiate ATCs and varsity baseball athletes and is feasible to implement. For example, viewing *Dangerous Game: The Truth About Spit Tobacco*[30] and *The Bob Leslie Story: A Tragic Choice*,[31] viewing graphic photographs of young people with oral-cancer-related facial disfigurement, and receiving a mouth examination were cited as helpful components of the intervention by 96, 96, and 94% of the exposed intervention-group athletes, respectively. Further research is needed to evaluate the contribution of the particular intervention components to the prevention of ST use in this population. Others[46,47] have reported, however, that physical unattractiveness and adverse short-term oral health consequences are more effective deterrents to tobacco use for adolescents and young adults than long-term health consequences. The process of providing information about action-consequence relationships may heighten individuals' feelings of susceptibility, cause them to weigh the pros and cons of initiating ST use, and provide incentive to remain tobacco free.

In summary, although our intervention, as delivered in this study, had no effect on ST cessation, it did have a significant effect on noninitiation of ST use. ST initiation of 5.1% in intervention colleges versus 8.4% in control colleges may be somewhat modest, but a nationwide ATC program could prompt thousands of athletes a year to remain tobacco free despite membership in a high-risk group. Implementation of this low-contact program that incorporates oral-cancer screenings during mandated preseason health screenings of collegiate athletes, however, would require a partnership among ATCs, local dentists, dental hygienists, and student-athlete leaders. Future research is needed to determine the efficacy of the separate components of the intervention on ST use among collegiate athletes.

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